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other plants of various families. One notable plant of this character is a certain variety of Hosackia Purshiana, whose leaves turn eastward in the morning and westward in the afternoon. To facilitate this, all the branches and leaves grow toward the north and south, so that the leaves simply have to turn over. In the case of the Silphium laciniatum, where the two surfaces of the leaf are just about alike, the leaves do not turn one face upward, but stand vertical, with one face to the east and the other to the west, and with the edges north and south. Thus, the leaves, which are rigid, get the benefit of all the sunlight; and the plant only grows on an open prairie, in a sunshiny country.

AN IMPROVED FIRE-SCREEN; AND NOTES ON THE THERMAL RESISTANCE OF FIRE-SCREENS.

BY T. H. DINSMORE, EMPORIA.

[*Abstract.*]

This fire-guard is so constructed as to secure neatness of design and unusual security from fire. The subject of thermal resistance of fire-screens is reviewed, and it is shown that resistance varies directly with the distance from the fire, and inversely with the meshes of the guard.

METHODS OF COLLECTING, CLEANING AND MOUNTING DIATOMS.

BY GERTRUDE CROTTY, LAWRENCE.

The diatomaceæ, called by the writers of the early part of this century bacillariaceæ, are now generally considered to be unicellular microscopical algeæ. This classification is based upon their usual method of reproduction—that by fission or division. Several eminent scientists, however, as Dr. Farlow, of Harvard College, yet hold that, on account of their freedom of motion, they ought to be placed in the animal kingdom.

The first forms of this microscopical plant were discovered at the close of the last century by the celebrated Danish micrographer, O. F. Müller. There have now been described over ten thousand varieties. This number is enormous, considering the fact that American forms have been little studied. With the exception of the late Prof. H. L. Smith, America has not produced what Dr. Henri Van Heurck means by his term "diatomophile." Owing to the fact that allowance has not been made for degeneration in size of any variety, due to division, it is very probable that this number has been unnecessarily increased.

Each individual diatom is incased within a silicious covering. This covering is composed of two halves, or valves, one fitting over the other as does a lid over a box. The point of union, the point where these two valves overlap one another, is termed the connective zone or girdle. These valves are marked by rows of punctures, or stria, except at the center, and frequently each end. The unstriated points are the nodules. These nodules are united by a line, the raphe, or median line. Each cell or plant contains a nucleus and nucliolus, protoplasm and a greenish-brown substance—the endochrome; likewise, several oily globules. Each plant is also covered by a mucilaginous coating, which may be detected by staining. I have observed thirty or forty diatoms of one variety adhering together by means of this covering, sometimes in a solid phalanx, and again drawn out in a line, until the tips only, of the frustules, overlap.

Let us return, for a moment, to the process of division. That agamic bipartition cannot continue indefinitely without senile degeneration is evident; and the first sign of degeneration is reduction in size. By division the cell contents first separate, and then the two valves; two new valves of silica having been secreted. Hence, each of the two new individuals is again incased within a silicious shell composed of half of the old frustule and half of the new. It is evident that the new plant, possessing the lid for its outer covering, would be larger than the one incased within the box. Hence, let me say again, that size cannot be a very important factor in determining a variety.

The process of division continues with wonderful rapidity. Prof. H. L. Smith says: "I have been unable to ascertain the time occupied in a single act of division, but, supposing it to be completed in twenty-four hours, we should have as the progeny of a single frustule the amazing number of 1,000,000,000 in a single month." Others claim that the division is completed in three and six hours.

My purpose, however, is not to consider methods of reproduction, but to tell you, from my limited experience, what methods I have found most convenient for collecting, cleaning and mounting our Kansas varieties.

Light and moisture alone are necessary for the development of diatoms; hence, they may be found in running or standing water, but never in putrid water. In case the growth is luxurious, they will be found as a greenish-brown layer upon submerged stems and leaves of plants, upon rocks, or the surface of mud. In Kansas they are usually found upon the surface of the mud — our streams have usually mud bottoms. By means of a shallow dipper or long-handled spoon, the collector may obtain a quantity of this slime, mixed with earth. The fluid thus collected should be well shaken and poured into a flat dish, where it is allowed to settle for several hours. The heavy earthy particles will sink to the bottom of the dish, while the surface will be covered with a thick brownish coating. All the supernatent water should be poured off gently, or, better, carefully removed with a small pipette. Gently touch the dry finger to the green covering and wash off the adhering particles into a small vial. If care is taken that the touch be light, diatoms almost entirely free from foreign matter may be obtained. I have frequently tried the well-known process of gigging, but have invariably failed to obtain pure diatoms, since our fine clay will be held in suspension as readily as will the light diatoms. Moreover, the clay of Douglas county contains so much silica, that, once mixed with the cleaned diatoms, it is almost impossible to extricate them from the white, clinging, flocculent mass. Any chemical which will destroy the flocculent silica will also attack the frustules.

The pure diatoms, once obtained within the vial, may be cleaned — or, in other words, freed from their cell contents — in various ways. A very common and useful method is to boil them in acid — sulphuric, nitric, or hydrochloric. I usually boil them in concentrated sulphuric acid, and destroy the carbon thus formed with nitric acid. A test tube will be found a very convenient receptacle during boiling. Allow the liquid to cool, and, after a few hours, the diatoms will have settled to the bottom of the tube. Pour off the supernatent acid and fill the tube with pure cistern water, or, better still, distilled water. Again allow the contents to settle, and pour off the water. Repeat this process until all traces of the acid have been removed. Be not discouraged if it is necessary to repeat this process twenty or thirty times. Once freed from the acid, the beautiful white frustules are ready for mounting.

Dry upon a slide or cover-glass a drop of the pure water containing them. Care should be taken that the water used for washing is chemically pure, or else crystals will be formed, attaching the diatoms to each other or to the slide. Moreover, if all the acid has not been washed out, crystals will likewise be formed. As an instrument for picking up the diatoms, a sharpened swine's bristle or a mouse's whisker will be found most excellent. If the experimenter wishes to mount them free-hand under the microscope, this bristle may be fastened to a pen-holder or any handle by means of a drop of wax or Canada balsam. Since a diatom $\frac{1}{1500}$ of an inch long is considered above the average size, and few of the varieties found about here are of the larger varieties, one finds free-hand mounting almost an impossibility. I experimented for three months last spring, and was rewarded by a loss of patience and enthusiasm, but succeeded in acquiring a steady hand, and alas! but five mounts. By using the mechanical finger, however, I have succeeded within the last month, working at odd moments, in selecting out and mounting about fifty varieties. All these varieties have been selected from collections made from one stream. I usually select out eight or ten of a variety and transfer them to a cover-glass lightly coated with glycerine. The glycerine is evaporated by the heat of an alcohol lamp, leaving the diatoms firmly attached to the cover-glass. A drop of Canada balsam is placed upon a slide, and the cover-glass is gently dropped upon the balsam. The slide is kept for several days with the cover-glass side downward until the balsam is sufficiently hardened to prevent any change of position taking place.

I might venture to add that, like other plants, certain varieties of diatoms seem to flourish at different seasons of the year. Perhaps my observations are too limited to allow me to make, with any definiteness, such a statement. From the same ravine, however, I made collections last February and May. The varieties that prevailed in February were fewer in May. Collections made from the same place in September of this year show that varieties seldom seen in the spring — for example, Pleurasigma, Navicula, and some of the Surirella, as robusta, are plentiful. While some varieties so common in the spring, as Surirella spiralis, I have failed to find at all this fall. Whether these varieties "run out," so to speak, and regenerate more frequently than once a year, that is, at more than one season of the year, I cannot of course determine from but one year of observation. It is evident that they have resting seasons. I might add, however, that some varieties, as Synedra, seem to be uniformly distributed throughout the seasons.

A COMPARISON OF PRESERVATIVE FLUIDS FOR MUSEUM USE.

BY V. L. KELLOGG AND E. E. SLOSSON, LAWRENCE.

[*Abstract.*]

A satisfactory preservative fluid for museum use, especially for the preservation of insect forms, is a desideratum of much importance. Much trouble and lack of success is experienced in the endeavor to preserve specimens without shrinkage, or swelling, or loss of color. A satisfactory preservative fluid for biological collections in entomology must perfectly, or as nearly perfectly as possible, preserve the animal tissue from deterioration, and must not change the colors. Alcohol is the most commonly-used preservative fluid, but while preserving the tissues, it affects colors in almost all cases. Specimens kept in glycerine frequently retain their colors, but are likely to fall to pieces on being handled. Carbolic acid effects marked changes in the tissues.

The experimenters have prepared an extensive series of preservative fluids, so-